Understanding By Design Unit On Operations & Algebraic Thinking:
Understanding Patterns, Functions, Coordinating Planes Grade 4 **Curriculum and Assessment: Mr. Mike Rospenda 12/5/11**

Title of Unit	Operations & Algebraic Thinking: Understanding Patterns, Functions, Coordinating Planes	**Grade Level**	4th Grade
Curriculum Area	Math/Algebra (transition to Geometry)	**Time Frame**	Up to 4 weeks
Developed By	Jan Marnocha		
Sources used:	www.scholastic.com Math Expressions – Volume 2 www.MathFactCafe.com www.proteacher.net www.nj.gov/education/aps/.../Mathematics_Areas_of_Focus_4th.pdf		

Identify Desired Results (Stage 1)

Content Standards

Common Core Standards Mathematics » Grade 4 » Operations & Algebraic Thinking
Use the four operations with whole numbers to solve problems.
4.OA.1. Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.
4.OA.2. Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.1
4.OA.3. Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.
Gain familiarity with factors and multiples.
4.OA.4. Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.
Generate and analyze patterns.
4.OA.5. Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.
National Math Standards Grades 3–5 Expectations:
In grades 3–5 all students should–describe, extend, and make generalizations about geometric and numeric patterns;
represent and analyze patterns and functions, using words, tables, and graphs.

Understandings	Essential Questions	
Overarching Understanding	**Overarching**	**Topical**
Big Idea for Unit: Algebra provides language through which we communicate the patterns in mathematics.	**Patterns:** 1. How can change be best represented mathematically? 2. How can patterns and	1. What are the characteristics of a pattern? 2. When might you use a pattern?
Related Misconceptions		

Students sometimes recognize a relationship between two steps in a growing pattern and assume they have identified the functional relationship.	functions be used as tools to best describe and help explain a real-life situation? **Functions**: 3. How are patterns of change related to the behavior of functions**?** **Coordinate Plane:** 4. How can we best represent and verify geometrical &algebraic relationships?	3. What are the characteristics of a function? 4. When might you use a function? 5. What are the characteristics of a coordinate plane? 6. When might you use a coordinate plane? 7. When might you use these three things together?

Knowledge Students will know…	**Skills** Students will be able to…
1. All students will represent and analyze relationships among variable quantities and solve problems involving patterns, functions, and algebraic concepts and processes. 2. The symbolic language of algebra is used to communicate and generalize the patterns in mathematics. 3. Algebraic representation can be used to generalize patterns and relationships. 4. Patterns, relations and functions, can be represented graphically, numerically, symbolically or verbally. 5. Make the important connection between geometry and algebra with the facilitation and visualization of algebraic relationships as well as an analytical understanding of geometry.	**Recognize, describe, extend and create patterns.** • Descriptions using words, number sentences/expressions, graphs, tables, variables. • Sequences that stop or that continue infinitely. • Whole number patterns that grow or shrink as a result of repeatedly adding, subtracting, multiplying by, or dividing by a fixed number. • Sequences can often be extended in more than one way. • Investigate the occurrence of geometry in nature and art. **Use concrete and pictorial models to explore the basic concept of a function.** • Input/output tables, T-Charts • Combining two function machines • Reversing a function machine **Locate and name points in the first quadrant on a coordinate grid.** • Use coordinates to give or follow directions from one point to another on a map or grid.

Assessment Evidence (Stage 2)

Performance Task Description – Week 1 - Patterns

Goal	Describe, extend and make generalizations about repeating and growing & shrinking patterns. Extend a pattern in more than one way.
Role	Explain and produce repeating and growing patterns.
Audience	4th grade classmates, teacher and possible principal
Situation	Challenge involves making connections to mathematical and real life applications of patterns
Product/Performance	1. Real life examples of patterns in art, music, life, numbers 2. Creating rules for patterns 3. Show the extension of patterns 4. Student presentation and explanation 5. Students will participate in M. Hunter math activities
Standards	There are different assessments for each day of the week and each activity

Performance Task Description – Week 2 - Functions

Goal	Given input and output of a function, use an operation or its inverse to find an output. Write input or output values for functions that represent one or two operations. Make a function table to represent a problem, and write a rule and an equation for it.
Role	Use concrete and pictorial models to explore the basic concept of a function.
Audience	4th grade classmates, teacher and possible principal
Situation	Challenge involves making connections to mathematical and real life applications of patterns
Product/Performance	1. Visual assessment of input/output on white boards 2. Function machine game with dice (input/output) 3. Money review, find sums of coin patterns 4. Student turn in worksheets of chart with two operations for output 5. Students will produce tessellations and present them
Standards	There are different assessments for each day of the week and each activity

Performance Task Description – Week 3 - Coordinate Plane

Goal	Read and plot points in the first quadrant of the coordinate plane. Determine the side lengths of two-dimensional figures.
Role	Locate and name points in the first quadrant on a coordinate grid.
Audience	4th grade classmates, teacher and possible principal
Situation	Challenge involves making connections to mathematical and real life applications of patterns
Product/Performance	1. Think, pair, share understanding of two step operations 2. Make 3D coordinate plane 3. Find coordinates on maps 4. Alphabet Coordinates (code) 5. Horizontal and Vertical Distance
Standards	There are different assessments for each day of the week and each activity

Performance Task Description – Week 4 – Review and Connections

Goal	Students will be reviewing patterns, functions and coordinate planes. Continue to make strong connections and ask questions.
Role	You are making connections and collecting as much information as possible.
Audience	4th grade classmates, teacher and possible principal
Situation	You are preparing and creating the final project of your choice and presenting it to the class.
Product/Performance	1. Final project of students choice. Individual or group project involving patterns, functions or coordinating planes.
Standards	Final project is assessed by peers and teacher. Rubric created by students.

Other Evidence

Students will be participating in many different activities and lessons – they will be doing higher level thinking, making real life connections, transferring knowledge, working in groups, working individually, producing products and activities. They will be assessing each other and giving each other feedback as well as checking in with the teacher who will be assessing, giving feedback and most importantly checking for understanding and transfer of knowledge.

Learning Plan (Stage 3)

Where are your students headed? Where have they been? How will you make sure the students know where they are going?	We will want students making connections that involve seeing relationships between different topics and drawing on those relationships as we move through the 3 weeks. The connections are important so the student understand how mathematics is used in science, social studies, and the arts. Students will be assessed on different activities, projects and presentations daily.
How will you hook students at the beginning of the unit?	Patterns: Playing a strong musical piece playing loudly with a definite pattern. Showing striking pictures in nature with obvious and strong patterns to their structure. Functions: Human Function Machine Game Coordinate Planes: Scavenger Hunt in school

What events will help students experience and explore the big idea and questions in the unit? How will you equip them with needed skills and knowledge?	**Big Idea for Unit: Algebra provides language through which we communicate the patterns in mathematics.** Patterns: 1.Real life examples of patterns in art, music, life, numbers 2. Creating rules for patterns 3. Show the extension of patterns 4. Student presentation and explanation 5. Students will participate in M. Hunter math activities Functions: 1. Visual assessment of input/output on white boards 2. Function machine game with dice (input/output) 3. Money review, find sums of coin patterns 4. Student turn in worksheets of chart with two operations for output 5. Students will produce tessellations and present them. Coordinate Planes: 1. Think, pair, share understanding of two step operations 2. Make 3D coordinate plane 3. Find coordinates on maps 4. Alphabet Coordinates (code) 5. Horizontal and Vertical Distance Through appealing to students visually, auditorially, kinesthetically, tacitly and other varied approaches for the understanding and connection to real life applications of patterns, functions and coordinate planes.
How will you cause students to reflect and rethink? How will you guide them in rehearsing, revising, and refining their work?	Student will be given writing prompts, time and activities to practice and explore together and alone, peer assessment, visually demonstrating and presenting orally. A chance to deliver the same information but in varied formats. Make real life connections and have choices.
How will you help students to exhibit and self-evaluate their growing skills, knowledge, and understanding throughout the unit?	Student will be producing projects, giving oral presentations, writing in math journals, teaching and explaining to each other and to the teachers. Presentations and projects may be recorded or put on display.
How will you tailor and otherwise personalize the learning plan to optimize the engagement and effectiveness of ALL students, without compromising the goals of the unit?	There are differentiated learning plans for all weeks of the unit. The teacher will be willing and flexible to change the unit as it progresses to best fit the needs of all students without compromising the goals of the until.
How will you organize and sequence the learning activities to optimize the engagement and achievement of ALL students?	All activities will be done at the same time. The differentiation will use the same information but possibly changing 1. The amount of work to be done 2. The level of thinking 3. The modality in which the work is completed. See Differentiated Learning sheets.

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